

## Pantheon Report

Generated at 2018-09-03 10:16:42 (UTC).  
Data path: GCE London on `ens4` (*remote*) → GCE Tokyo on `ens4` (*local*).  
Repeated the test of 4 congestion control schemes twice.  
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

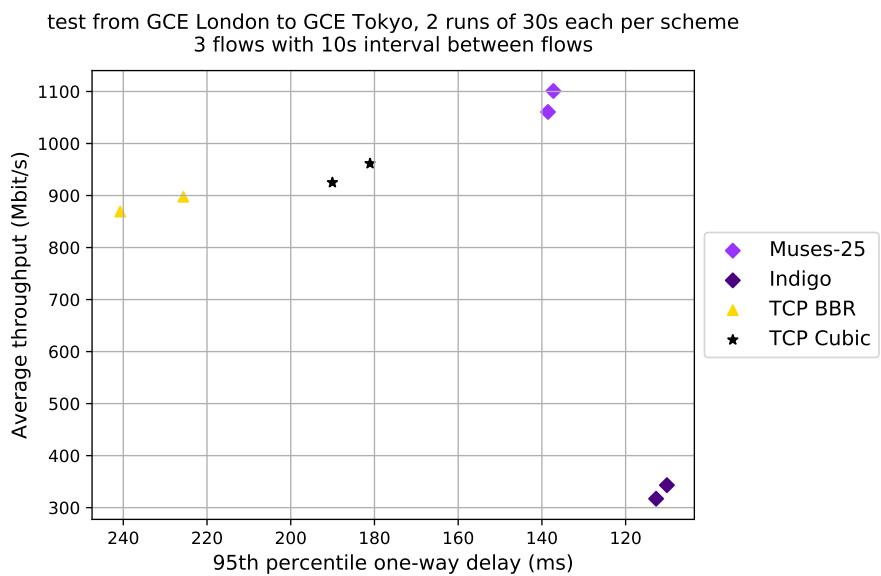
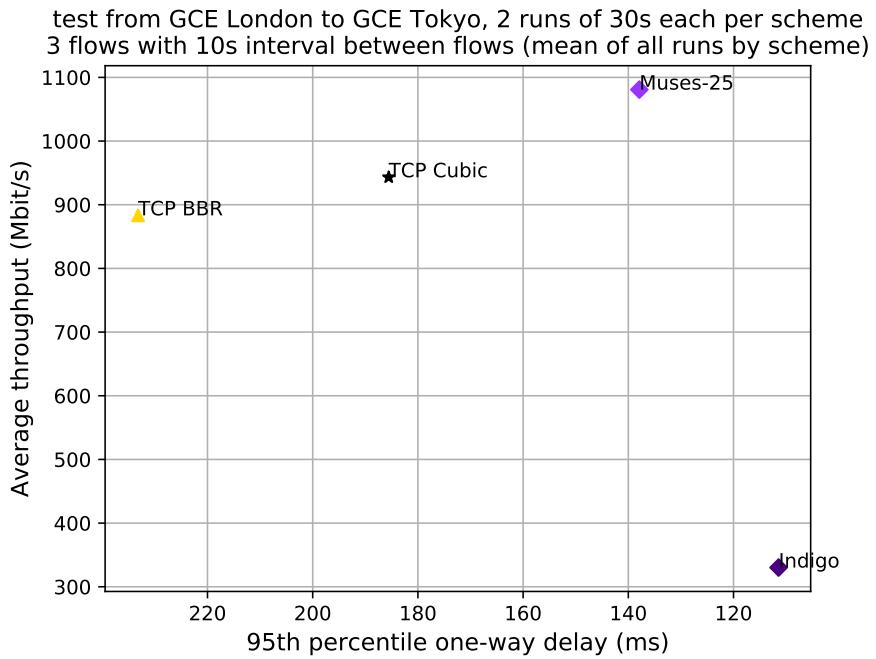
NTP offsets were measured against `time.google.com` and have been applied to correct the timestamps in logs.

System info:

```
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```

Git summary:

```
branch: muses @ f309f5459e2c5237279a184e52ece7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b8d5019b83a3a678804d830fcfe1da7b3a63421b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafe1771f813cd646339e1952
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
  M receiver/src/buffer.h
  M receiver/src/core.cpp
  M sender/src/buffer.h
  M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
  M src/ScreamClient
  M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
  M src/verus.hpp
  M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```



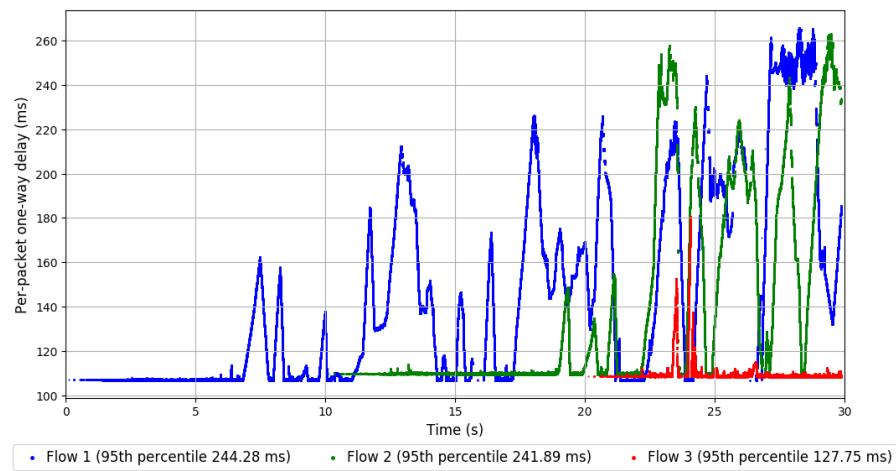
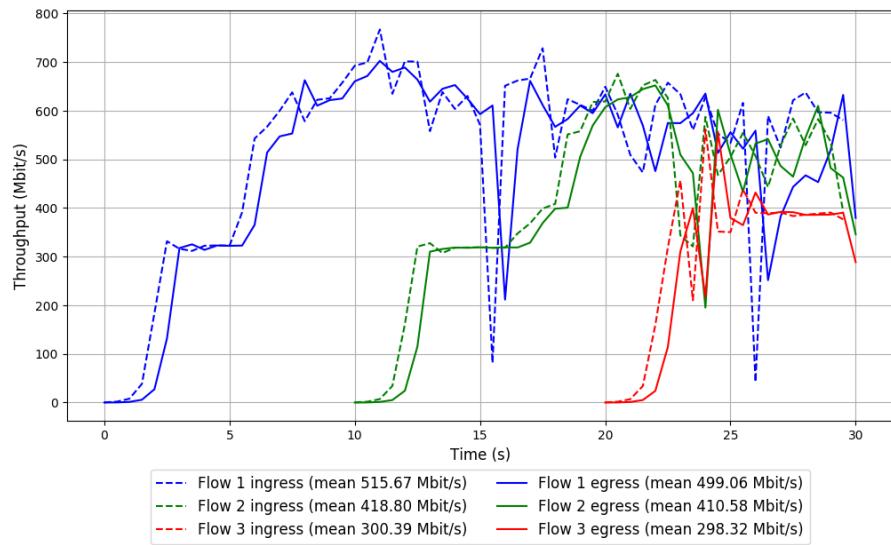
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	507.20	417.87	301.80	230.85	243.49	138.14	3.02	3.46	2.88
TCP Cubic	2	524.40	481.16	303.88	192.74	189.84	126.95	0.83	1.46	3.93
Indigo	2	157.32	182.94	160.57	110.63	111.79	113.92	0.77	1.14	2.67
Muses-25	2	518.58	553.90	603.76	133.07	137.54	141.71	0.78	1.44	2.95

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 09:47:04
End at: 2018-09-03 09:47:34
Local clock offset: 11.421 ms
Remote clock offset: 2.813 ms

# Below is generated by plot.py at 2018-09-03 10:15:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 869.15 Mbit/s
95th percentile per-packet one-way delay: 240.732 ms
Loss rate: 3.54%
-- Flow 1:
Average throughput: 499.06 Mbit/s
95th percentile per-packet one-way delay: 244.281 ms
Loss rate: 3.93%
-- Flow 2:
Average throughput: 410.58 Mbit/s
95th percentile per-packet one-way delay: 241.886 ms
Loss rate: 3.05%
-- Flow 3:
Average throughput: 298.32 Mbit/s
95th percentile per-packet one-way delay: 127.755 ms
Loss rate: 2.89%
```

## Run 1: Report of TCP BBR — Data Link

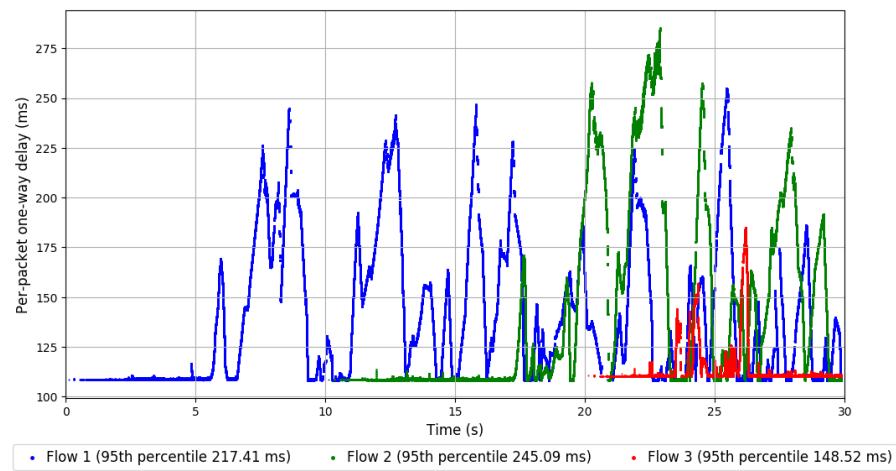
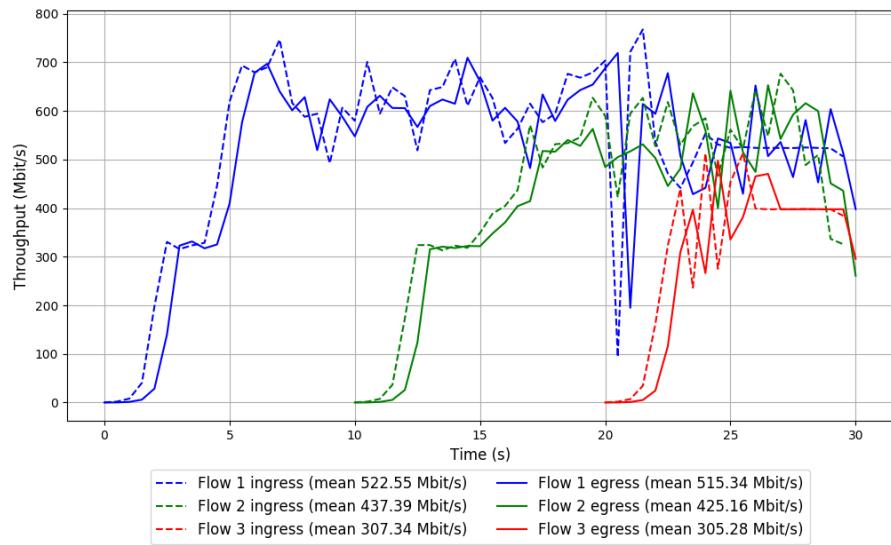


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 09:55:07
End at: 2018-09-03 09:55:37
Local clock offset: 15.935 ms
Remote clock offset: 2.512 ms

# Below is generated by plot.py at 2018-09-03 10:15:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 897.49 Mbit/s
95th percentile per-packet one-way delay: 225.646 ms
Loss rate: 2.75%
-- Flow 1:
Average throughput: 515.34 Mbit/s
95th percentile per-packet one-way delay: 217.410 ms
Loss rate: 2.10%
-- Flow 2:
Average throughput: 425.16 Mbit/s
95th percentile per-packet one-way delay: 245.085 ms
Loss rate: 3.87%
-- Flow 3:
Average throughput: 305.28 Mbit/s
95th percentile per-packet one-way delay: 148.517 ms
Loss rate: 2.88%
```

## Run 2: Report of TCP BBR — Data Link

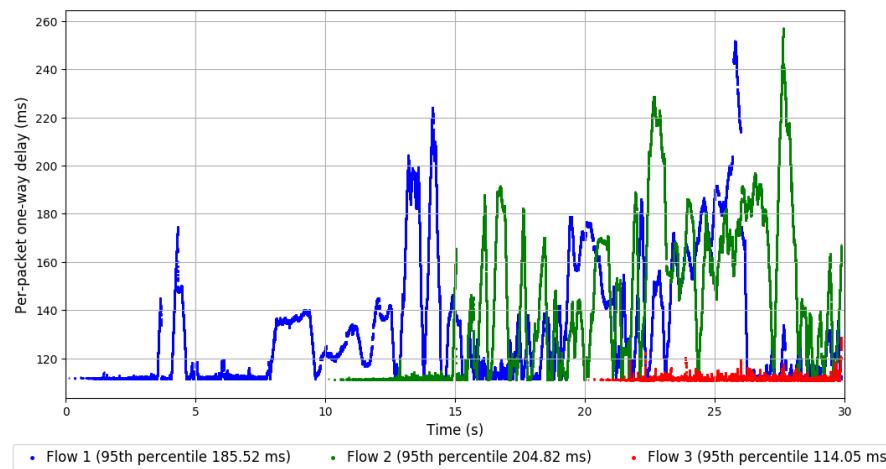
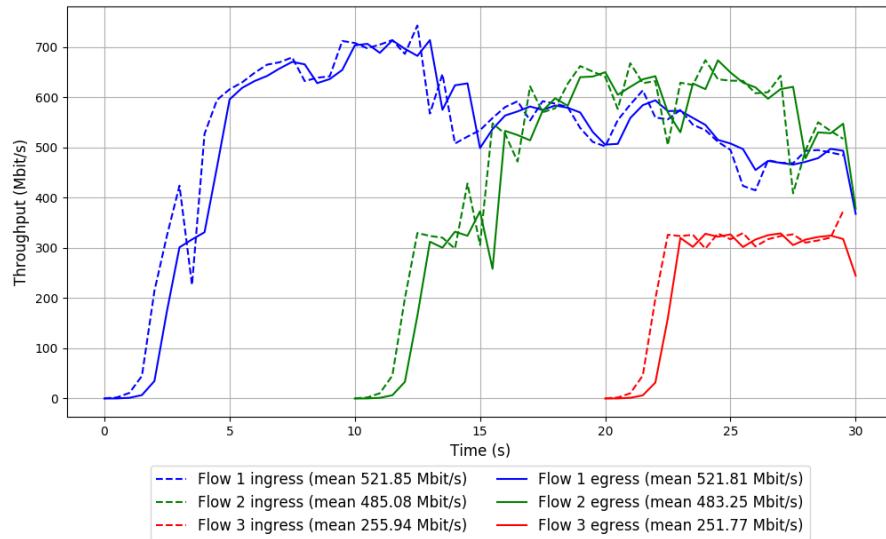


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-03 09:50:58
End at: 2018-09-03 09:51:28
Local clock offset: 14.689 ms
Remote clock offset: 1.785 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 924.93 Mbit/s
95th percentile per-packet one-way delay: 190.045 ms
Loss rate: 1.28%
-- Flow 1:
Average throughput: 521.81 Mbit/s
95th percentile per-packet one-way delay: 185.524 ms
Loss rate: 0.75%
-- Flow 2:
Average throughput: 483.25 Mbit/s
95th percentile per-packet one-way delay: 204.822 ms
Loss rate: 1.48%
-- Flow 3:
Average throughput: 251.77 Mbit/s
95th percentile per-packet one-way delay: 114.046 ms
Loss rate: 3.81%
```

## Run 1: Report of TCP Cubic — Data Link

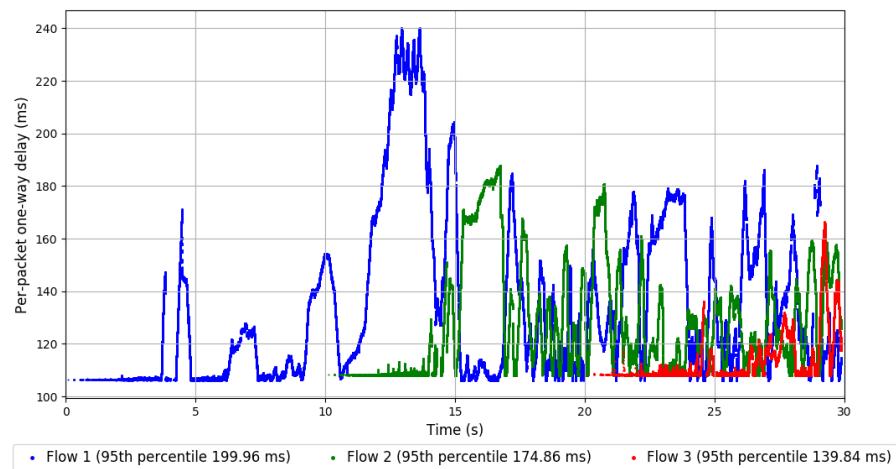
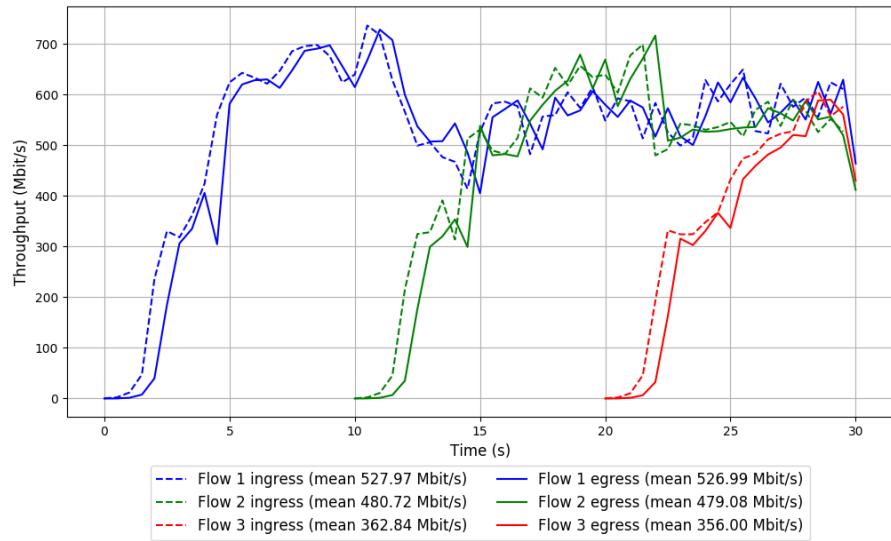


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 09:59:05
End at: 2018-09-03 09:59:35
Local clock offset: 14.438 ms
Remote clock offset: 1.579 ms

# Below is generated by plot.py at 2018-09-03 10:16:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 961.43 Mbit/s
95th percentile per-packet one-way delay: 181.052 ms
Loss rate: 1.48%
-- Flow 1:
Average throughput: 526.99 Mbit/s
95th percentile per-packet one-way delay: 199.961 ms
Loss rate: 0.91%
-- Flow 2:
Average throughput: 479.08 Mbit/s
95th percentile per-packet one-way delay: 174.858 ms
Loss rate: 1.45%
-- Flow 3:
Average throughput: 356.00 Mbit/s
95th percentile per-packet one-way delay: 139.845 ms
Loss rate: 4.05%
```

## Run 2: Report of TCP Cubic — Data Link

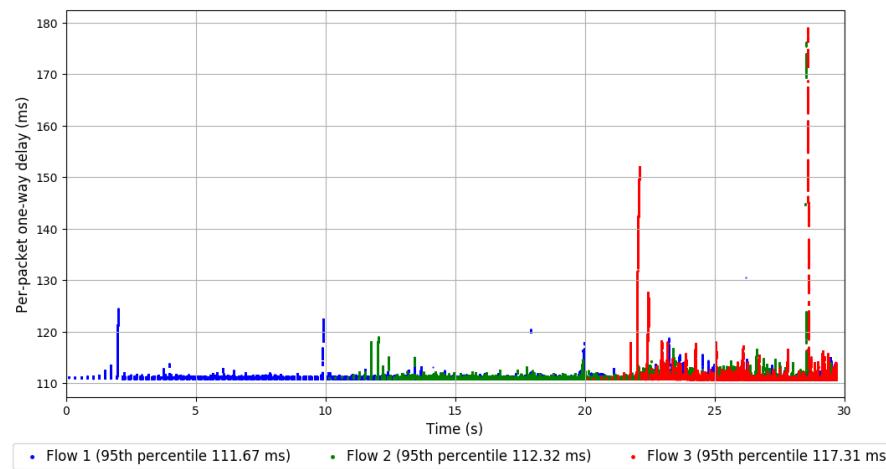
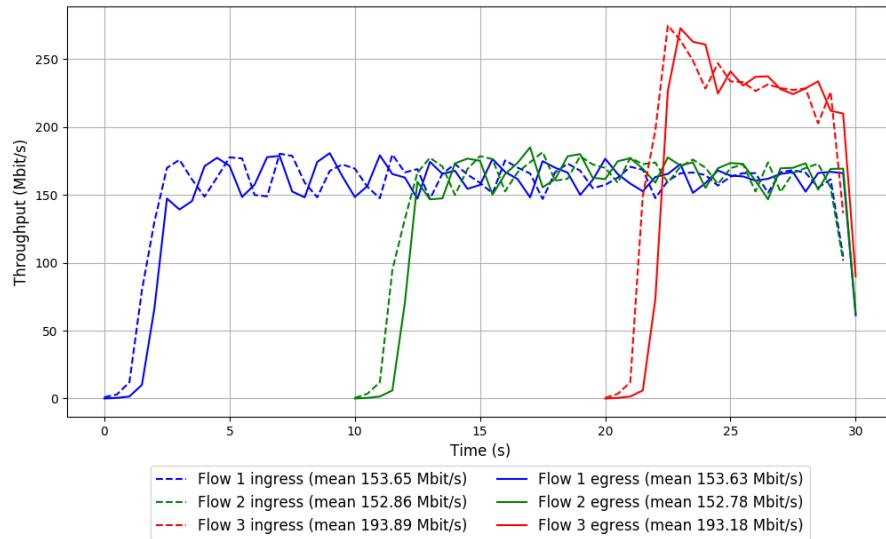


Run 1: Statistics of Indigo

```
Start at: 2018-09-03 09:49:12
End at: 2018-09-03 09:49:42
Local clock offset: 14.485 ms
Remote clock offset: 2.368 ms

# Below is generated by plot.py at 2018-09-03 10:16:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 317.15 Mbit/s
95th percentile per-packet one-way delay: 112.723 ms
Loss rate: 1.26%
-- Flow 1:
Average throughput: 153.63 Mbit/s
95th percentile per-packet one-way delay: 111.667 ms
Loss rate: 0.77%
-- Flow 2:
Average throughput: 152.78 Mbit/s
95th percentile per-packet one-way delay: 112.319 ms
Loss rate: 1.17%
-- Flow 3:
Average throughput: 193.18 Mbit/s
95th percentile per-packet one-way delay: 117.314 ms
Loss rate: 2.61%
```

Run 1: Report of Indigo — Data Link

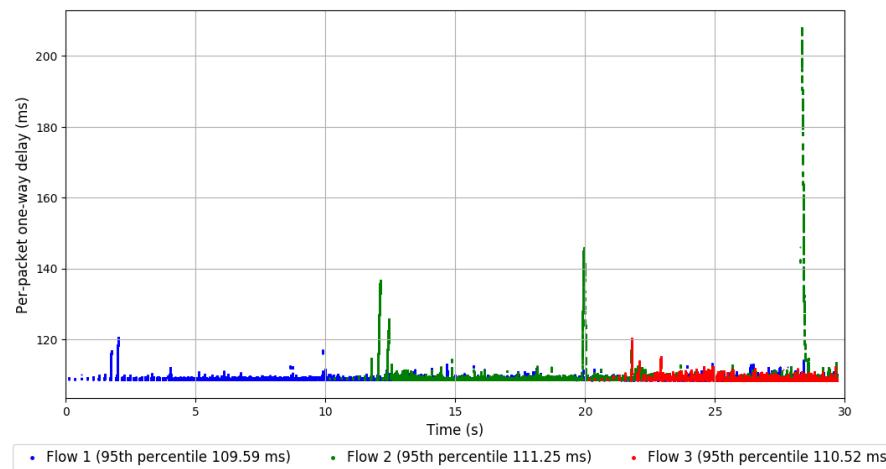
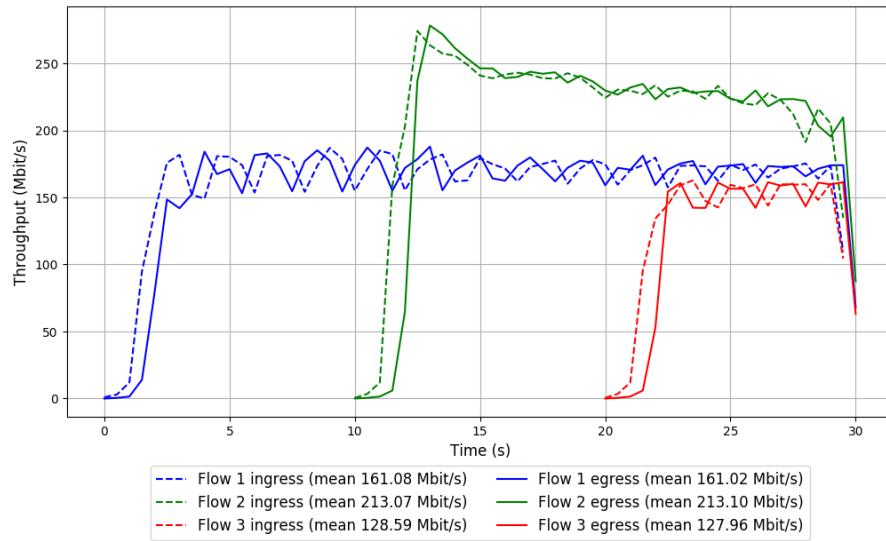


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 09:57:16
End at: 2018-09-03 09:57:46
Local clock offset: 16.617 ms
Remote clock offset: 2.092 ms

# Below is generated by plot.py at 2018-09-03 10:16:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 343.21 Mbit/s
95th percentile per-packet one-way delay: 110.137 ms
Loss rate: 1.15%
-- Flow 1:
Average throughput: 161.02 Mbit/s
95th percentile per-packet one-way delay: 109.591 ms
Loss rate: 0.77%
-- Flow 2:
Average throughput: 213.10 Mbit/s
95th percentile per-packet one-way delay: 111.254 ms
Loss rate: 1.10%
-- Flow 3:
Average throughput: 127.96 Mbit/s
95th percentile per-packet one-way delay: 110.522 ms
Loss rate: 2.73%
```

Run 2: Report of Indigo — Data Link

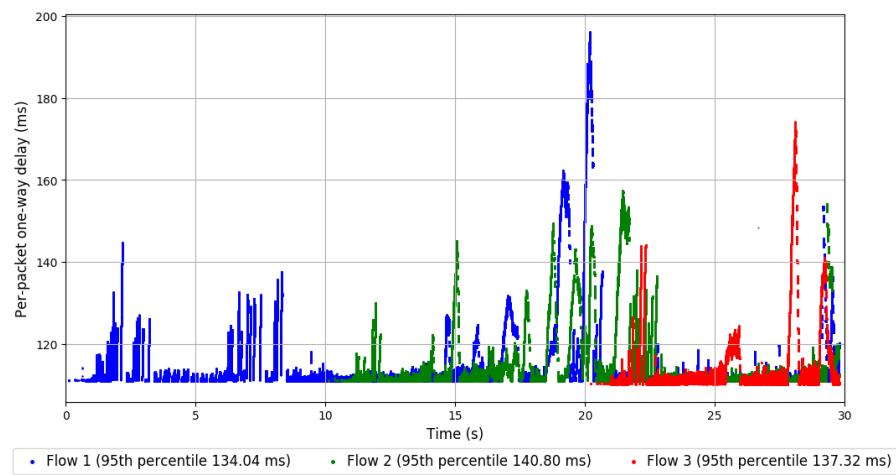
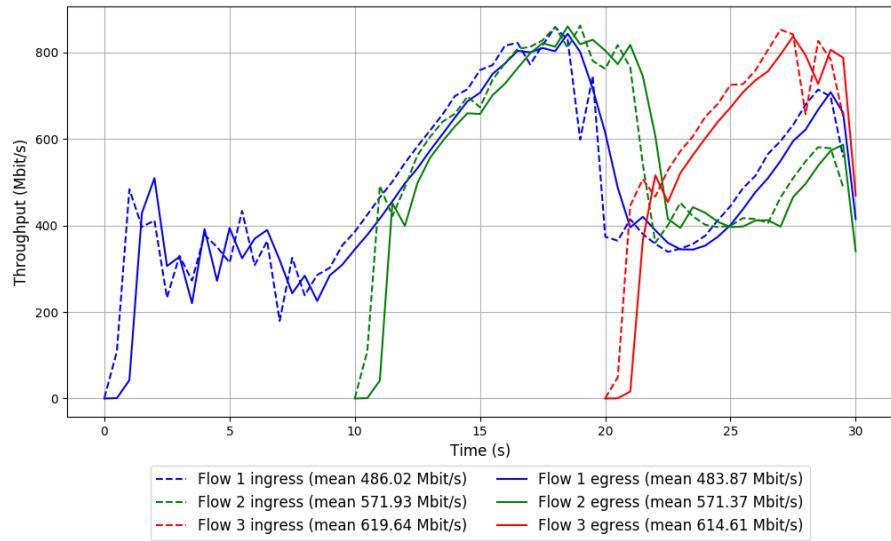


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 09:45:00
End at: 2018-09-03 09:45:30
Local clock offset: 14.367 ms
Remote clock offset: 3.763 ms

# Below is generated by plot.py at 2018-09-03 10:16:37
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1060.66 Mbit/s
95th percentile per-packet one-way delay: 138.546 ms
Loss rate: 1.55%
-- Flow 1:
Average throughput: 483.87 Mbit/s
95th percentile per-packet one-way delay: 134.036 ms
Loss rate: 1.18%
-- Flow 2:
Average throughput: 571.37 Mbit/s
95th percentile per-packet one-way delay: 140.800 ms
Loss rate: 1.21%
-- Flow 3:
Average throughput: 614.61 Mbit/s
95th percentile per-packet one-way delay: 137.323 ms
Loss rate: 3.06%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 09:53:03
End at: 2018-09-03 09:53:33
Local clock offset: 15.101 ms
Remote clock offset: 2.666 ms

# Below is generated by plot.py at 2018-09-03 10:16:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1100.97 Mbit/s
95th percentile per-packet one-way delay: 137.259 ms
Loss rate: 1.24%
-- Flow 1:
Average throughput: 553.29 Mbit/s
95th percentile per-packet one-way delay: 132.108 ms
Loss rate: 0.38%
-- Flow 2:
Average throughput: 536.44 Mbit/s
95th percentile per-packet one-way delay: 134.276 ms
Loss rate: 1.68%
-- Flow 3:
Average throughput: 592.91 Mbit/s
95th percentile per-packet one-way delay: 146.105 ms
Loss rate: 2.83%
```

Run 2: Report of Muses-25 — Data Link

